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Time-resolved diagnostics of high power pulsed magnetron discharges during formation of antimicrobial Ti-Cu thin films

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The goal of our work is to develop a method for coating of join implants by films combining antibacterial effect and good cellular adhesion of osteoblasts at the surface. Approach is to insert copper as a metal with known antimicrobial effect into the surface of titanium substrates which is a material with very good natural surface biocompatibility. For such purposes the amount of Cu and the structural bonds between particular Ti and Cu components in the film has to be controlled carefully.
The main aim of the contribution is a comparative study of different types of magnetron discharges with the view to reveal phenomena responsible for thin film formation. The in-situ diagnostic was done in (i) dc mode, (ii) high frequency pulsed and (iii) high power impulse magnetron sputtering systems during the deposition of thin films. Time-resolved diagnostic of ion flux and measurement of ion energy distribution function is combined with measurement of total energy flux (heating probe). Obtained results are employed together with time-resolved Langmuir probe diagnostic as input parameters for calculation of influx contributions of particular species, e.g. neutral particles. The active agents in the discharge are observed by time-resolved optical emission spectroscopy. Crystallographic phases of deposited thin films are diagnosed by grazing incidence x-ray diffractometry (XRD), chemical composition is measured by x-ray photoelectron spectroscopy (XPS). The work is partially supplemented by overview of bio-expertises (copper release, microbial and cell adhesion). Work was supported by the German Federal Ministry of Education and research (BMBF) though project Campus PlasmaMed. Further grant 202/09/0800 of the Grant Agency of the Czech Republic and projects KAN301370701 and M100100915 of AS CR are acknowledged

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